

DUAL PUMP

HP-12 -33

Instruction Manual

To The User

We ask that you read this manual carefully and in its entirety before installing and using the unit.

After reading please keep the manual for reference. A product warranty is attached at the back.



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Introduction

Thank you for purchasing the FLOM Dual Pump, Model HP-12 or HP-33.

- This instruction manual will assist you in the safe and proper operation of the HP Dual Pump, and will help prevent harm, damage and accident as you operate and maintain the unit.
- For safety's sake, please read this manual carefully before installing, wiring, connecting, and operating the unit.
- Please follow the Safety Notes found throughout the manual, as they contain key points about the safe handling and care of the unit.
- Please keep this manual in a safe place easily accessible to the actual operators of the unit. By following these instructions, you will ensure a long and safe operating life to the HP Dual Pump.

Note carefully the safety information given in the points below.

I. The Safety Notes are divided into 3 categories, in descending order of hazard: [Danger], [Warning], and [Caution]. For details please refer to “Section 1: Safety Precautions”. Read and understand these points well before operating the unit.

II. FLOM Corporation assumes no responsibility for the following:

- 1) accidents or problems occurring as a result of not following this manual's instruction.
- 2) accidents or problems resulting from the use of non-standard replacement parts (neither FLOM brand parts nor parts from a FLOM-approved vendor).
- 3) accidents or problems resulting from operating the unit outside the defined specifications and parameters.

III. If you wish to recondition the unit, always consult with FLOM first.

IV. Follow the instructions in this manual (Section 9: Maintenance) when you make repairs or perform periodic maintenance on the unit.

V. Do not install the unit in the locations listed under “Locations to Avoid” in Section 8-2: “Location of Installation and Storage”. In general do not install or use the unit in any place deemed hazardous for whatever reason.

VI. There is a product warranty on the last page of this manual. Please be careful not to damage or lose it. In case of loss, contact FLOM and inform us of the model and serial number of the unit (for custom specification units, please also supply the specifications). We will issue you another copy of the instruction manual, but please be aware that under certain circumstances the contents of the warranty may no longer be applicable.

1 Safety Precautions

Please read this instruction manual carefully and follow the instructions while installing, running, maintaining and servicing the degassing unit. Make sure you understand the basic operation of the unit, safety information, and the safety precautions listed below. Please keep this manual in a safe place easily accessible to the actual operators of the unit.

< Definition of Markers Denoting Safety Cautions >

The  Mark: This mark indicates matters of special concern and caution which need to be heeded *before* handling or running the unit. After the  mark, one of 3 words: **Danger**, **Warning**, or **Caution**, will appear indicating the level of hazard. For safety's sake please follow all instructions appearing after these marks.

- Safety caution categories indicate the degree of hazard resulting from mistaken application of the instructions.

 Danger

: A “Danger” Mark indicates the imminent and acute possibility of injury or death, if the situation or action described is not avoided.

 Warning

: A “Warning” Mark indicates the possibility of injury or death if the situation or action described is not avoided.

 Caution

: A “Caution” Mark indicates the possibility of moderate or light injury, or physical damage, if the situation or action described is not avoided.

In addition, the “※ Note” sign indicates important and useful reference information.

2. Standard Accessories List

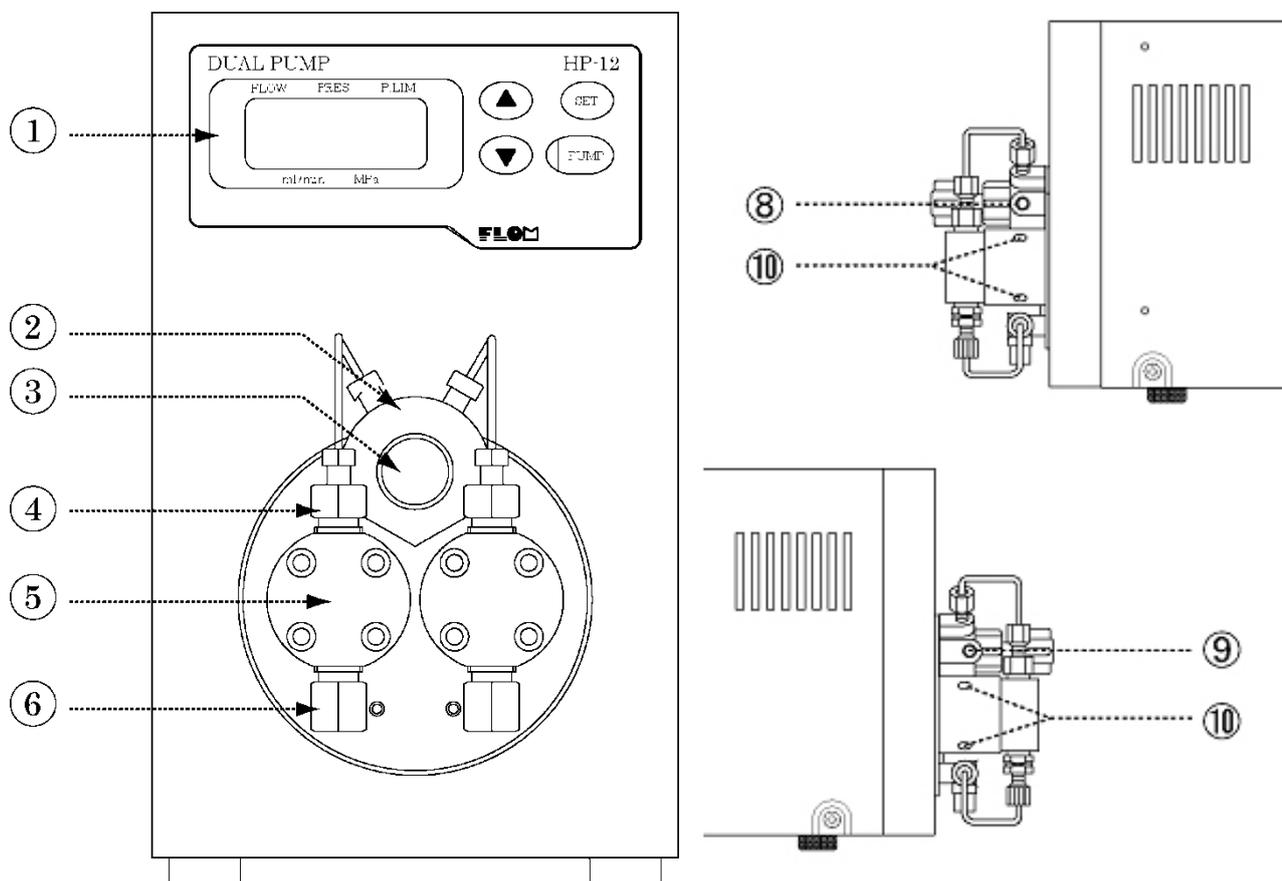
When opening the unit packaging, please check that all the accessories listed below are included.

※ Note: if you discover any accessory part to be missing or defective, please contact your vendor immediately. Please do not use off-market or knock-off parts on the unit; FLOM will not be responsible for any damage resulting from their use, and using such products may void the FLOM guarantee of free repair.

Part Name	Specifications	Number	Notes
Power Cord	7A 125V	1	
3-Prong Connector	15A 125V	1	
Fuse	T3A	2	Time-lag Type
Wrench	8 X 10	1	
Wrench	6 X 8	1	
2.5mm Hex Wrench	2.5mm	1	
SUS Tubing	1/16×1.0×1m	1	
1/16 Fitting S	#9501	2	Includes the one attached to aspiration needle
1/16 Ferrule	#9601	2	Includes the one attached to aspiration needle
STOP FITT	#9004	1	
Aspiration Needle		1	
Teflon Tubing	3φ x 2φ 1m	2	
Suction Filter	#8807	2	
1/8 Double Lock Fitting	#9304	2	
1/8 Double Lock Ferrule	#9405	2	

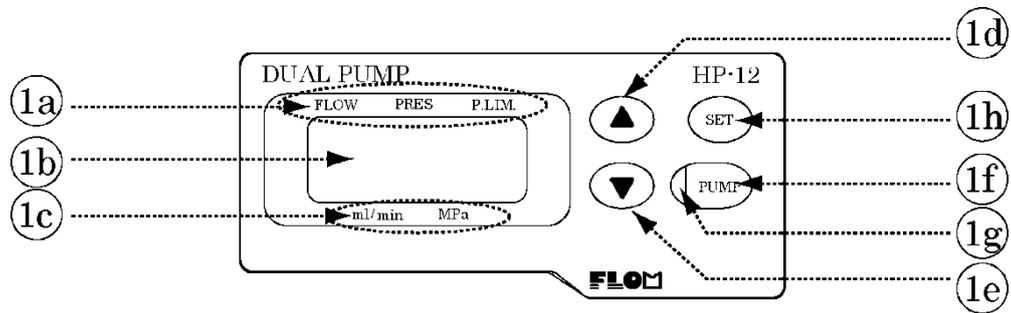
3 Part Names and Functions

3-1 Front and Side Panels



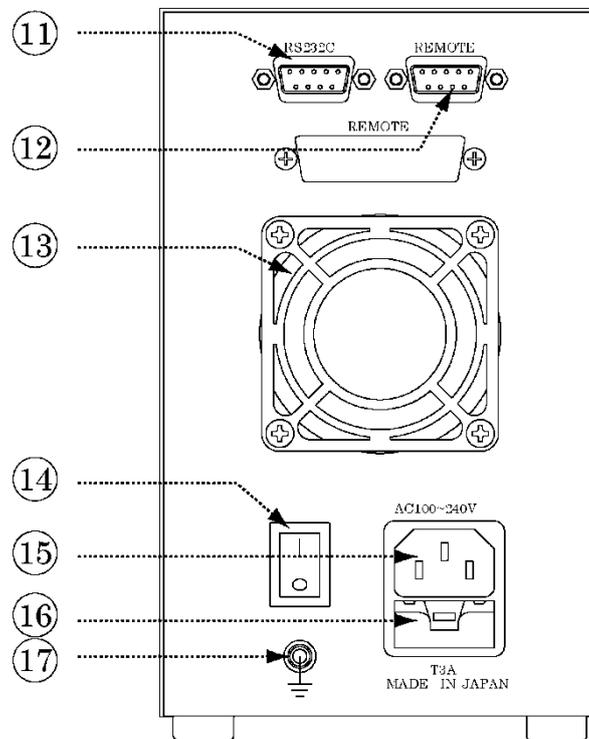
	Name	Function
1	LCD Display	Refer to Section 3-2 LCD Display
2	Drain Valve (housing for pressure sensor)	Right side connects to pump system, left side connects to drainage. Also houses pressure sensor.
3	Drain Valve Plug	Turn right to close drain, so only the pump side port (right side) flows. After solvent replacement, to degass turn left to open drain, and use a syringe to withdraw solvent from the drain port (left side).
4	Drain Side Check Valve	Pump mechanism
5	Pump head	Pump mechanism
6	Aspiration Side Check Valve	Pump mechanism, connects to aspiration tube
7	-----	
8	Pump System Port	Connects to analytical line (column).
9	Drain Port	Refer to ③ Drain Valve Plug
10	Wash Port	No. 10-32UNF

3-2 Display Panel



	Name	Function
1a	Display Indicator Area	Lit bar under the word indicates current parameter to change (flow, pressure, or pressure limit)
1b	Numerical Display Area	Indicates flow, pressure, and upper pressure limit values
1c	Units Indicator Area	Bar lit above word indicates current units
1d	UP Key	Increases currently indicated value
1e	DOWN Key	Decreases currently indicated value
1f	PUMP Key	Starts/stops pump operation
1g	Status Indicator LED	Lights green during pump operation, lights red in error state
1h	SET Key	Changes selected parameter (flow, pressure, or pressure limit)

3-3 Back Panel



	Name	Function
1 1	RS232C Terminal	9 pin D-Sub Male refer to section 10 – External Control
1 2	Remote Terminal	9 pin D-Sub Female refer to section 10 – External Control
1 3	Cooling Exhaust Fan	DC 24V Fan – Air Flow out of Unit
1 4	Power Switch	Rocker Switch
1 5	AC Inlet	Built-in Fuse Holder
1 6	Fuse Holder	Midget Type T3A 2 Fuses
1 7	Ground	Chassis earth. Always ground the unit.

4 Installation

4-1 Accessory Check

When first opening the unit packaging, check to make sure that all standard accessories are included. (See Section 2, Standard Accessory List.)

※ Note: If any accessories are missing or damaged, contact your vendor. FLOM corporation will not be held responsible for any problems resulting from the use of off-market or knockoff parts.

4-2 Electrical Connection



Warning

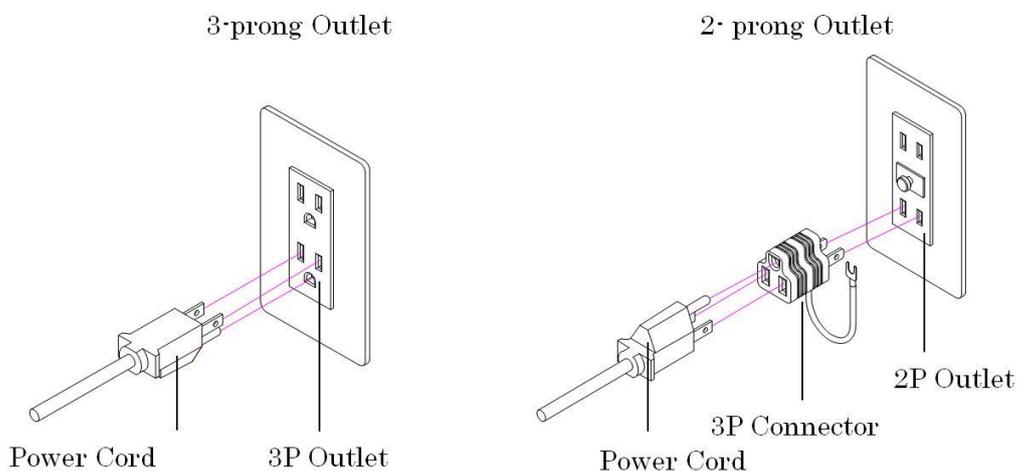
Holding the plug head of the power cord, insert into a nearby electrical outlet. Do not touch the cord with wet hands to avoid electric shock.



Caution

Your system may contain a large device that could produce an electrical surge in the autosampler unit if they are run from the same power outlet. In this case please connect the autosampler unit to a separate power outlet.

Plug the power cord provided with the unit into the connector on the back panel, and plug the other end into an indoor electrical outlet. The power source can be from AC 100V to 240V and can use both 50Hz and 60Hz frequencies. The cord provided is a 3-pronged triplex cable. If connecting to a 2-pronged outlet, always use a 3-pronged adapter unit in between. Always ground the unit as shown in the illustration below.

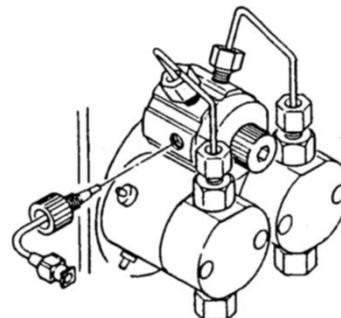


4-3 Aspirating Tube Connection

Connect the supplied Teflon tube to the aspiration port. Always connect a solvent filter on the other side of the tube.

4-4 Drain Needle Connection

Connect the supplied drain needle to the left-hand port on the drain valve.



4-5 Air Bleeding Procedure

Open the drain valve (turning left), connect the syringe barrel to the aspirating needle and pull plunger to draw solvent in and bleed air out of the pumphead. As you bleed air out of the pumphead, also turn on the pump to get solvent flowing. A flow rate of about 1ml/min is sufficient for solvent flow.

※ Note: always open and close the drain valve by hand; NEVER use a tool. Always place the solvent Bottle at a level at least as high as the pumphead.

4-6 Pump System Connection

Remove the STOP FITT attached to the pump system port on the right side of the drain valve and connect to the next unit in the system (injector, autosampler, etc).

4-7 Preliminary Pumping

After closing the drain valve (turn right), begin preliminary pumping.

5 Basic Operation

Consult Section 3: Part Names and Functions, if you are unsure about the functions of the various keys on the control panel. In the explanation below, parentheses [example: (1h)] indicate the number of that key as described in Section 3.

5-1 Parameter Change

Press the SET Key (1h) to cycle through the parameters and select which one to change: the cycle is Flow, Pressure, and P. Lim (pressure upper limit). The selected parameter will light up.

5-2 Setting Flow Rate

(Display Indicator Area (1a): with FLOW selected)

Use the UP and DOWN Keys (1d, 1e) to select flow rate.

Holding the key down continuously will increase the speed of change. Once flow rate is set, use the Pump Key (1f) to start the pump. You can also change the flow rate while the pump is operating.

5-3 Pressure Monitor

(Display Indicator Area (1a): with PRES selected)

Display LCD will show the current pressure in the pump system in MPa.

5-4 Setting Pressure Upper Limit

(Display Indicator Area (1a): with P.LIM selected)

Use the UP and DOWN Keys (1d, 1e) to select the pressure upper limit.

You can also change the pressure upper limit while the pump is operating. If the current pump pressure is higher than the limit value, the buzzer will sound and the pump will stop. The error message [Er 1] will appear in the Numerical Indicator Area (1b). Press any key to return the pump to normal operation, and reset the upper limit again.

6 Constant Pressure vs Metered Flow

To use this section you will first have to set the correct parameters as outlined in section 7. Advanced Operation below. Referring to Section 7, set the Flow Mode to the desired setting (constant pressure or metered flow) before changing the values described in this section.

6-1 Constant Pressure

Summary: this mode will automatically adjust the flow to keep pressure constant in the pump system. A pressure sensor inside the pump constantly monitors system pressure.

Setting the Pressure

The Pressure Upper Limit value as set in the Normal Flow Mode, becomes the constant pressure value in this mode. With P.LIM selected in the Display Indicator Area (1a), use the UP (1d) and DOWN (1e) keys to change the pressure value.

When the PUMP Key (1f) is pressed, the pump starts at the flow rate currently set. Once the pressure has stabilized, the pump automatically adjusts the flow rate to keep the pressure at the set value.

※ Note: “constant pressure” does not imply that the flow is non-pulsatile.

6-2 Metered Flow Setting

Summary: in this mode, you can set the volume to dispense beforehand, and the pump will automatically stop once the set volume has been delivered.

Setting the Metered Flow (Pumped Volume)

When P.LIM is selected in the Display Indicator Area, pressing the SET key (1h) again will cause BOTH the FLOW and PRES bars to light up. This is an additional selection which allows the setting of metered flow.

At this point, use the UP key (1d) and DOWN key (1e) to select the desired metered flow (the volume to be pumped). Press the PUMP key (1f) to start the pump. Once the selected volume has been pumped out the pump will automatically stop.

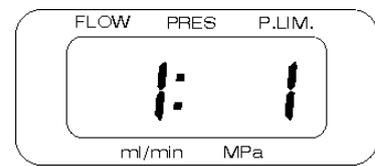
7 Advanced Operation

This section explains how to set the special parameters of the dual pump. There are 5 special parameters:

- ① Pulse Correction
- ② Flow Rate Correction
- ③ Pressure Drop Correction
- ④ Flow Mode
- ⑤ Automatic Setting to Zero Pressure

7-1 User Parameters

The 5 parameters listed above are all user-settable. If you hold down the SET key (1h) and turn on the power, the unit will automatically enter User Parameter Input Mode. In this mode the Display Indicator Area will light up in red and will show the blinking digits **1:** .

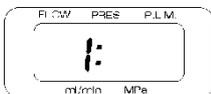


The lefthand numeral indicates the current selection, and the righthand numeral(s) show the current setting. Change the selection by pressing the SET key (1h), change the value by pressing the UP (1d) and DOWN (1e) keys. Press the PUMP key (1f) to preserve the current setting in the unit's memory.

You can also zero the pump pressure by repeatedly pressing the SET key (1h) until the Display Indicator shows the **END** setting. In this case, always have the drain plug (3) turned to the left to open the drain. Once the zeroing operation has finished, the pump will switch over to normal operation.

7-2 Pulse Correction

You can set Pulse Correction while in User Parameter Mode (see section 7-1 above)



: A value of "1" indicates Pulse Correction Function is active.

Refer to the Options Chart below, and use the UP (1d) and DOWN (1e) keys to turn the pulse correction function on and off. After setting, press the PUMP (1f) key to preserve the selection.

<u>Pulse Correction Options Chart</u>	
①	OFF
②	ON

7-3 Flow Rate Correction

You can set Flow Rate Correction while in User Parameter Mode (see section 7-1 above)



: A value of “2” indicates Flow Rate Correction Function is active.

The right-hand numerical indicates the flow rate correction percentage **in units of 0.1%** (but no decimal point is shown). Use the UP and DOWN keys (1d and 1e) to adjust the percentage. After setting, press the PUMP key (1f) to preserve the value.

(Example) To enter a correction value of +1.2%



As shown, set the right-hand numerals to “12” for +1.2%, and save.

(Example) To enter a correction value of -0.5%



Enter the same way as above, but since there is no minus sign (-) to display, you must carefully monitor the behavior of the display as you continuously press the UP (1d) or DOWN (1e) keys; i.e., if you press the DOWN key and the numerals increase, that indicates that you are in the minus numbers.

7-4 Pressure Drop Correction

You can set Pressure Drop Correction while in User Parameter Mode (see section 7-1 above)



: A value of “3” indicates Pressure Drop Correction Function is active.

The right-hand numerical indicates the pressure drop correction percentage **in units of 1% per 1MPa** (but no decimal point is shown). Use the UP and DOWN keys (1d and 1e) to adjust the percentage. After setting, press the PUMP key (1f) to preserve the value.

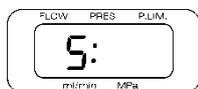
(Example) Setting a Pressure Drop Correction of 12.5% at 10 MPa



Since 12.5% divided by 10 MPa = 1.25, but the Indicator can only display 2 digits, the value is rounded up to 1.3, and the value of “13” is entered.

7-5 Choosing the Flow Mode

You can set Flow Mode while in User Parameter Mode (see section 7-1 above)



: A value of “5” indicates Flow Mode Function is active.

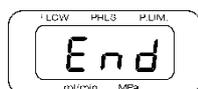
Refer to the Options Chart below, and use the UP (1d) and DOWN (1e) keys to select the Flow Mode. After setting, press the PUMP (1f) key to preserve the selection.

Flow Mode Options Chart	
①	Normal Flow
②	Constant Pressure
③	Metered Flow

※ **Note:** Selection ②, Constant Pressure, is only available on the model KP-22. If Selection ② is selected on the model KP-21, the pump will remain in Normal Flow Mode.

7-6 Automatic Setting to Zero Pressure

You can set Automatic Setting to Zero Pressure while in User Parameter Mode (see section 7-1 above)



: When “End” shows on the Indicator Area, press the PUMP key (1f).

Pressing the PUMP key (1f) automatically begins the Zero Pressure function, so always make sure that the drain valve plug (3) is turned left to open the drain valve *before* pressing the PUMP key.

Once the Zeroing operation has finished, the unit exits the User Parameter Mode and switches to normal operation.

7-7 List of Other Settable Functions

Item	Description	Range	Notes
6	Pump Number	1 – 9	To identify pump during RS232C control
7	Motor Start Speed	-10 to +10	
8	Low Pressure Limit Timeout	1 – 999 (seconds)	Error message generated when pressure stays below set value for this amount of time
9	Stop bit (RS232C)	1 = 1 bit 2 = 2 bit	Default = 2 bit
11	Low Pressure Limit	0 - 349 (×0.1MPa)	
12	Auto Error Generation (RS232C)	0 = no error sent 1 = error sent	Default = error sent
1 5	Value Setting Method	0 = Rotary 1 = UP/DOWN only	Behavior of Panel when setting values Default = Rotary

8 Key Points of Operation

8-1 Special Precautions during Operation



Warning

: The points below are all WARNINGS. Avoid these actions and situations at all times.

- Never wet the panel or cover of the unit with water or solvents, organic or otherwise. If solvent is inadvertently spilled on it, unplug the unit and clean immediately. Do not start the unit until it is completely dry. A wet unit is a hazard for fire, short circuits, electric shock and unit damage. If you suspect a large volume of solvent has leaked into the unit interior, contact your vendor for advice.
- Never allow stainless steel tubing or metal fragments of any kind to enter the unit through the cover vents. This could cause short circuits, electrical shock, damage or injury.
- Do not attempt to repair or dismantle the unit if you suspect a technical problem, nor attempt to convert or upgrade it yourself. Doing so could cause fire, electrical shock, or injury.
- When changing the pump head or head guide seals, always turn off the power switch on the back panel, and unplug the power cord from the AC outlet. Do not plug or unplug with wet hands. Do not attempt any remove or replace of components except for the seal. Doing so could cause electric shock or damage. Refer to “Section 9: Maintenance” when replacing the seal.



Caution

: The points below are CAUTIONS. Be sure to follow them to ensure safe operation of the unit.

- Do not run this unit on an electric power system outside the standard AC 100V-240V (50/60 Hz) range. Doing so could result in fire, electrical shock or damage.
- If a malfunction occurs, stop operation immediately. Contact FLOM, providing clear descriptions of the problem. Using the unit after malfunction could cause fire, electrical shock, or injury.
- Treat the electric power cord carefully: do not excessively bend, treat, tuck into small spaces, wrap up, bind up, or place under heavy objects. Doing so could result in fire, overheating, and electrical shock.
- Do not cover the waste liquid outlet on the side or the vent on the back of the unit with paper or tape. Doing so could result in fire, overheating, or damage.
- When using a buffered solution, change the solvent about once a week, first injecting distilled water from the wash port. Doing so will decrease wear on the plunger and the plunger seal, helping to prevent leaks and increasing the unit’s durability. For more details refer to Section 9: Maintenance. (A wash kit is available as an option.)

8-2 Location of Installation and Storage



Danger

: The points below are all dangerous HAZARDS. Avoid these actions and situations at all times.

- This device is not rated explosion-proof. Never use in an environment with an explosion hazard. Doing so will result in a high risk of death, injury and/or fire hazard.
- This unit features a compact design, but do not place in a location above head level or where the unit could easily fall. Doing so could result in death, injury, or damage to the unit.



Caution

: The following locations are not suitable for installation or storage of this unit. Placement in any of these locations may result in leaks or damage to the unit.

- Do not use or store the unit out-of-doors.
- Do not use or store the unit near a source of corrosive gas.
- Strong electromagnetic waves can cause malfunctioning in nearby CPUs, so do not use the unit near high-frequency equipment.
- Do not place the unit in vibrating or unstable locations.
- Do not place in direct sunlight or sources of high heat.
- Do not use or store in places with high humidity.
- One important condition is to always use and store the unit at room temperature (indoors). Avoid use or store under extremes of temperature. (Appropriate temperatures for installation or storage: around 4° – 45° C in areas without water condensation.)
- When storing the unit for extended periods, fill the head and wash ports with distilled water or alcohol. In particular, always store filled with distilled water after using a buffered solution.

※ **Note:** Always place the solvent bottle at a level at least as high as the pumphead.

9 Maintenance

9-1 Washing the Plunger

9-1 : プランジャーの洗浄



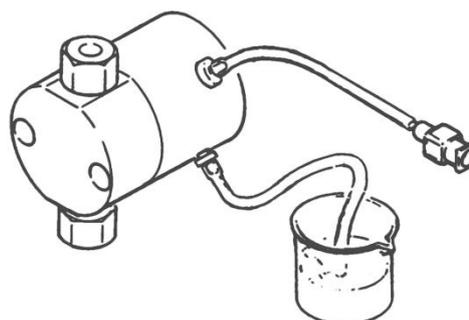
Caution

Please follow the instructions carefully and in full. Ignoring these instructions could easily result in a malfunction in the moving parts of the pump unit.

Since using a buffered solution as a solvent can result in a build-up of salts on the plunger and cause noticeable damage to the seal, it is important to regularly wash the plunger to remove these salts by connecting a silicone tube to the upper part of the wash port (refer to Section 3: Part Names and Functions), and using a syringe to inject distilled water into the head. The unit does not have an automatic wash function, so fresh distilled water should be injected in every 3-7 days.

You can order a wash kit as an option, but it's perfectly fine to use your own tubing if you have it.

The illustration on the right shows the connection on the wash side. The upper part is where the distilled water is injected. The bottom part discharges waste water into a beaker.

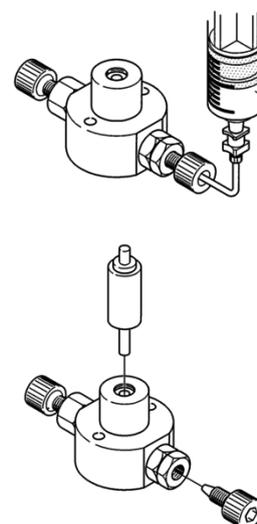


9-2 Changing the Plunger Seal

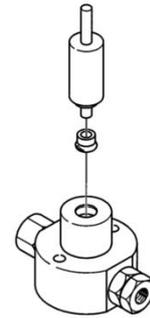
The plunger seal is a consumable item. It must be replaced regularly.

Usually, only the plunger seal inside the pumphead is changed. When using the wash port, the plunger seal in the pumphead guide should also be changed at the same time. To change the seal, follow the procedure outlined below.

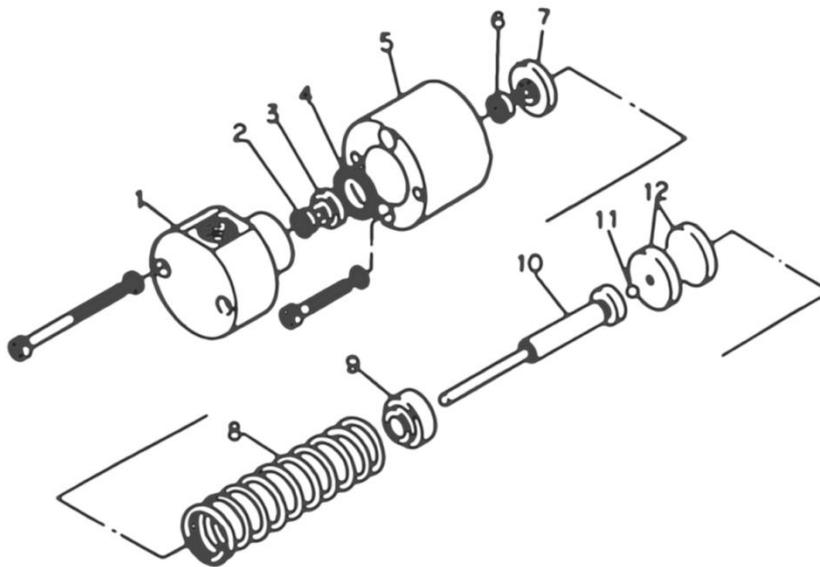
Step	Action
1	Remove the connections to the aspiration and discharge check valves.
2	Loosen the pumphead screw. Use the hex L wrench supplied with the unit.
3	Pull the pumphead straight off the unit body.
4	Remove the worn seal from the head. 1. After sealing off the exhaust side check valve on the head with a cap, connect an aspiration needle to the check valve on the aspiration side, and inject distilled water with a syringe until it overflows. 2. Insert the rounded, unstoppered long end of the seal insert tool (option) all the way in. 3. The seal will float due to internal pressure, so repeatedly add water until the seal sticks to the tool and can be removed with it. 4. If the O-ring is still stuck inside, be sure to remove it.



5	<p>Insert the new seal into the head.</p> <ol style="list-style-type: none"> 1. Set the new seal on to the stoppered, short side of the seal insert tool (option). Be very sure that the O-ring is on the OUTER side of the seal. Putting in the O-ring and the seal separately can easily damage the seal, so always make sure that the O-ring is placed in together with the seal. 2. Slowly insert the seal using a circular motion. Jamming the seal directly in may damage the O-ring and become a source of leakage, so be careful at this step. 3. Push in until the pumphead and seal insert tool overlap. Remove the seal insert tool, and prepare the pumphead for reattachment.
6	<p>Reattach the head to the main unit, tighten the pumphead screw, and reconnect all tubing.</p>



9-3 Moving Parts Diagram



1	Pumphead	7	Plunger Guide
2	Plunger Seal	8	Spring
3	Backup Ring	9	Plunger Adapter
4	O-Ring	10	Plunger
5	Head Guide	11	SS Ball Bearing
6	Wash Seal	12	Spacer

9-4 Washing the Check Valves

The major cause of bad flow is problems in the check valves. Bubbles, contaminants and grit can get trapped between the bearing and the valve seat, or the valve can dry causing the bearing to stick to the seat.

If bubbles are causing a problem with flow, refer to Section 4-5: Air Bleeding Procedure. If air bleeding does not solve the problem, there is probably some contaminant or grit stuck between the bearing and valve seat. In this case, follow the procedure outlined below to wash the check valve.

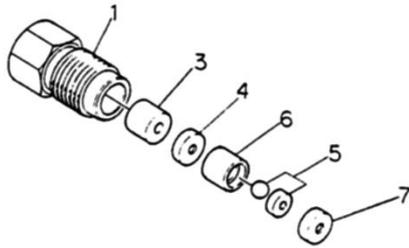
Step	Action
1	Remove all tubing from the aspiration or discharge check valves. On the discharge side, use the 8mm wrench provided with the unit.
2	Remove the aspiration or discharge check valve from the pumphead. Use the 10mm wrench provided with the unit.
3	Wash the check valve in a beaker with either alcohol or distilled water (if using a buffered solution always use distilled water), and clean with ultrasound for 10-20 minutes.
4	After cleaning reattach check valve to the pumphead. Be careful to put both the aspiration and the discharge valves back in the right place! After tightening the check valve snugly by hand, use the wrench to turn it another 90°. ※ Note: be careful when tightening by wrench. It is very easy to overtighten and damage the valve.
5	Reattach all tubing to the aspiration and discharge check valves. When reattaching tubing to the discharge side, similarly to reattaching the check valves, first snugly tighten by hand, then use the wrench to give it an extra 60° twist. ※ Note: be careful when tightening by wrench. It is very easy to overtighten and damage the valve.
6	When tubing is reattached, allow solvent to flow in and remove all air bubbles. Refer to Section 4-5: Air Bleeding Procedure.

The procedure above should eliminate all contaminants and grit in the majority of cases and allow the unit to function properly again. If this doesn't solve the problem, then the check valve itself will have to be disassembled and each separate part thoroughly washed.

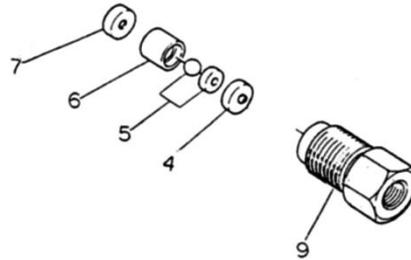
To disassemble a possibly malfunctioning check valve, first remove it from the unit. and place a STOP FITT cap on the joint and rotate by hand. Doing so will slowly bring the inner mechanism out from the valve cartridge. Inspect and clean the check valve interior mechanism, using the notes below.

Check Valve Mechanism Reassembly Notes

- The mirror surface side of the valve seat is where the bearing goes. (easily detected by shining a light on it.)
- Always use tweezers to set the bearing and the valve seat into the valve case.
- Seal A (index #4) is not as thick as Seal B (index #7), and Seal A goes on the **INSIDE** of the valve cartridge. Do not mix them up!
- The valve cases for the aspiration side and the discharge side face in opposite directions; do not mix them up.
- Seal B should be pushed in evenly. (Seal B is a consumable; we recommend replacing with a new seal each time disassembly is done.)



Discharge Side Check Valve



Aspiration Side Check Valve

Index #	Part Number	Name	Specifications
1	#2115	1/16" Valve Cartridge	No.10-32 UNF PEEK
9	#2114	1/4-28 Valve Cartridge	1/4-28 UNF PEEK
3	#2005	Tapered Spacer	PEEK
4	#2006	Seal A	1.5mm PCTFE
5	#2008	Ball and Valve Seat	Ruby & Sapphire
6	#2009	Valve Seat Case	PEEK
7	#2007	Seal B	2.0mm PCTFE

10 External Control

10-1 RS232C Communication Protocol

RS232C communication is enabled thru the RS232C port on the back panel. The connector is D-SUB 9 pin male connector. Use a cross-cable when connecting to a PC.

Communications Settings

Baud Rate	9600 bps
Data bits	8 bit
Parity bit	none
Stop bit	2 bit (or 1 bit*)
Flow control	none

* Refer to Section 7: Advanced Operation

Command List

All commands are in ASCII format.

Add a CR or LF delimiter byte to the end of every command. CR or LF are not shown on the command list below but must be added when sending any command.

Command lengths are fixed; if a portion of the code is not needed, fill in with a 0 insert.

Decimal points are not used in any command.

■ PC → Pump

Operation Command	Description	Notes
P1,G1,1	Start Pump	
P1,G1,0	Stop Pump	
P1,S2,n	Set Pulse Correction Function	Set "n" to one of the following to set pulse correction. n : 1 = pulse correction OFF n : 2 = pulse correction ON
P1,S3,nnnnn	Metered Flow Volume	Set "nnnnn" to indicate volume of metered flow. Units are $\mu\text{L}/\text{min}$.
P1,SE,n	Error Generation	Set "n" to indicate state of error generation. n : 0 = error generation OFF n : 1 = error generation ON
P1,S6,nnn,mmm	Pressure Limit Settings	Set "nnn" to indicate pressure upper limit, "mmm" to indicate pressure lower limit. Units are 0.1MPa, no decimals.

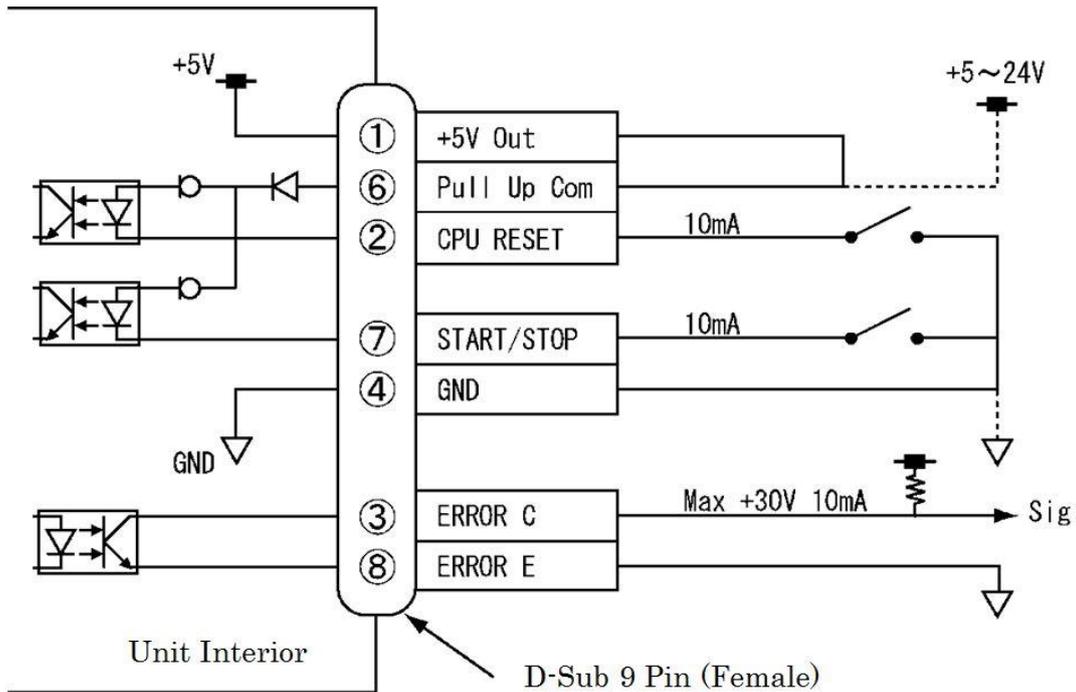
P1,Q2	Request Current Status	<p>Pump unit responds with the following codes to indicate current status.</p> <p><u>P1,Q2,n,00,mmmm,yyy</u></p> <p>n : 0 = currently stopped 1 = currently running 9 = currently generating error D = currently switching to stop</p> <p>mmmm : current flow rate in µL/min</p> <p>yyy : current pressure in 0.1MPa (no decimals)</p>
P1,Q3	Request for parameter values	<p>Pump unit responds with the following codes to indicate current status</p> <p><u>P1,Q3,n,mmmm,00000,00000,yyy,zzz</u></p> <p>n : pulse correction status</p> <p>mmmm : flow rate in µL/min</p> <p>yyy : pressure upper limit in 0.1MPa units (no decimals)</p> <p>zzz : pressure lower limit in 0.1MPa units (no decimals)</p>
P1,Q5	Request for cam rotation value	<p>Pump unit responds with cam rotation integration value.</p> <p><u>P1,Q5,nnnnnnnn</u></p> <p>nnnnnnnn : cam rotation integration value</p>
P1,R,n	Error reset	<p>Set “n” to reset condition as follows.</p> <p>n : 2 = reset error state : 4 = reset cam rotation integration value</p>

■ Pump → PC

Operation Command	Description	Notes
P1,OK	Answer OK	Operation or setting command received correctly: will perform as requested.
P1,E,nn	Error Command	<p>Error condition in pump; sent by pump when command error is detected.</p> <p>nn : 10 = command format unrecognizable 20 = requested value outside limits 21 = requested value higher than max limit 22 = requested value lower than min limit 33 = cannot fulfill this command during operation 35 = forbidden command (contradictory info) received 61 = max pressure error 62 = min pressure error 66 = overheating error 67 = motor rotation malfunction error</p>

10-2: Remote Input/Output

Use the REMOTE terminal on the back panel for external input/output. The connector is a D-SUB 9-pin female type. Power to run the photocoupler on the printed circuit board can either be supplied by the power supply running the whole unit (internal source) or by an external source provided by the customer (external source). But if the noise inherent in the internal supply is of concern, we recommend using an external source for external control. Furthermore, when using an external source, do not connect either ① (+5V Out) or ④ (GND), instead refer to the graph below for wiring of the unit, and note the dashed line.



	Signal	Description	
1	START/STOP Input	Start and Stop Pump Commands.	
		Photocoupler OFF→ON	Start Pump
		Photocoupler ON→OFF	Stop Pump
2	CPU RESET Input	Reset Pump Unit Internal CPU. Used when restarting pump unit.	
		Photocoupler ON	Reset CPU (stop unit)
		Photocoupler ON→OFF	Restart Pump
3	Error Output	Signal ⇒ DC30V or less 10mA or less	
		Error Generation	Photocoupler ON
		Normal Operation	Photocoupler OFF

11 Troubleshooting

11-1 Error Messages and Corrective Measures

E r 1	Pressure Upper Limit Error
Pressure exceeds upper limit.	
<ul style="list-style-type: none"> • Check tubing and column for clogging. • Especially check joints away from the pump. 	
E r 2	Pressure Lower Limit Error
Pressure drops below lower limit.	
Pressure lower limit can only be set by RS232C protocol or by the advanced setting operation. The default is 0.0MPa so in the usual case this error will not be generated.	
<ul style="list-style-type: none"> • Check tubing and column for leaks. • Check if solvent bottle is empty. 	
E r 6	Overheating
Motor IC is overheated.	
<ul style="list-style-type: none"> • Check that nothing is obstructing the side vents and the ventilation port. • Repeated overheating may mean trouble with unit itself. Contact your vendor for a service call. 	
E r 7	Motor Rotation Error
Insufficient motor torque, can't handle load.	
<ul style="list-style-type: none"> • Sudden jump in pressure during operation leads to flow malfunction. • Dust or grit on internal sensor limits detection and flow malfunction results. Contact your vendor for a service call. 	

11-2 Other Problems

No Power
<ul style="list-style-type: none"> • Check breaker, plug and socket. • Check fuse. • Check AC voltage (should be between AC100-240V). • An AC voltage greater than 250V will damage the power switch. In this case contact your vendor for a service call.
Noise in the Unit
<ul style="list-style-type: none"> • Is the front panel touching the pumphead? Add extra tubing to the pump ports. • Is the pump touching some other unit? Always leave at least 2cm space on either side to allow air into the side vents. • Are any tubes touching the exhaust fan in the back?
Unstable Flow Rate
<ul style="list-style-type: none"> • Check AC voltage (should be between AC100-240V). <p>AC voltages below 90V will not allow the motor to output enough torque, negatively impacting pump performance.</p>
Odors
<ul style="list-style-type: none"> • Cut the power and immediately contact vendor for a service call. Provide the vendor with a clear and full description of the problem

12 List of Options

This is of consumable and optional items which can be ordered for the pump unit.

Part Number	Name	Specifications	Total	Notes
#2207	Plunger Seal	7φ for inorganic solutions	2	
#2227	Plunger Seal	7φ for ionic solutions	2	
#2208	Plunger Seal	7φ for organic solutions	2	
#2226	Wash Seal	7φ	2	
#2228	Seal Insert Tool	7φ	1	
#2315	Wash Kit	Silicone	1	includes aspiration needle

13 Specifications

Part Number	HP-12-33
Flow	Parallel Double Reciprocating Plunger
Max Output Pressure	20.0MPa(～25ml/min) 10.0MPa(～50ml/min)
Flow Rate Range	0.1～50.0ml/min
Flow Rate Setting	UP/DOWN Key / RS232C
Pressure Sensor	Inline
Plunger Diameter	7φ
Cam Stroke	4mm
1 Head Volume	154μl
Flow Stability	±0.3%
Fluid Path Materials	SUS316 Ruby Sapphire PCTFE
External Control	Remote Control: START/STOP INPUT, CPU RESET INPUT, ERROR OUTPUT Communication Protocol: RS232C
Functions	Flow Rate Correction Metered Flow Press Loss Correction Constant Pressure Flow Pulsed Correction
Power	AC 100V ～ 240V (50/60Hz)
Dimensions	(w)110 × (D)395 × (H)184 (excluding protuberances)
Weight	about 7.5kg

※ Specifications and outer appearance may be changed without notice in order to improve performance.

※ Product improvements of the pump unit may lead to inaccuracies in the pictures and diagrams featured in this manual.

14 Product Warranty

Product Warranty

Thank you for purchasing this FLOM product.

FLOM Corporation guarantees the performance of this product for one (1) year.

FLOM Corporation will assume responsibility for covering the costs of repair and/or replacement for any defect in, or damage to, the unit, occurring within this period, when such defect or damage can be shown to be the responsibility of FLOM. However, FLOM Corporation will assume no responsibility for defects or damage due to, or substantially similar to, the following circumstances or conditions:

- 1) operating the unit not in accordance with the instructions given in the operating manual under section 8: Key Points Of Operations;
- 2) mistakes in operation;
- 3) repairs or reconditioning not done by FLOM;
- 4) earthquakes, fire, catastrophes or other acts of God;
- 5) all defects or damage resulting from causes not inherent in the unit;
- 6) high temperature, high humidity, extremely low temperature, corrosive gas, constant high vibration and other factors produced by extreme environments
- 7) replacement of consumables and similar parts.

Filling out the information below is required to activate the warranty. If the required information is missing the warranty may be null and void.

Model _____

Serial Number _____

Purchase Date: _____

Dealer: _____

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